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Communication from George H. Corliss - 1873

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6

COMMUNICATION

FROM

GEORGE H. CORLISS,

IN REVIEW OF THE REPORTS OF THE WATER COMMISSIONERS
AND THE CHIEF ENGINEER OF THE WATER WORKS,

UPON THE

PUMPING ENGINE

AT HOPE STATION.

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REPORT.

PROVIDENCE, R. I., Nov. 26, 1873.

TO THE HONORABLE THE BOARD OF ALDERMEN:

GENTLEMEN:—By your permission, I will herewith submit for your consideration, the following review of so much of the reports which the water commissioners and their chief engineer made to you on the 20th instant, as relates to the design, construction and working of the machinery which I have furnished under contract, for Hope pumping station, and to the extraordinary performances of Cornish engines.

It is admitted that "the service at Hope station is variable and peculiar, requiring for the best results a great range of automatic regulation," and the commissioners say that they "gladly accepted an offer made by Mr. Corliss, to furnish an engine to be constructed by himself, on his own plans." Well might they be glad, thus to pass over to other hands, this difficult task, while they reserved for themselves the designing of an engine "for permanent work at Pettaconset, where the service is to be simple, heavy and uniform in its character."

The chief engineer charges, that "this engine as at present arranged, is not sufficiently like the mill engines, so admirably made by Mr. Corliss, as to warrant or allow a comparison to be made with them." For the work at Pettaconset station the engine *would be* like the mill engines, and the regulation by the throttle would have no application there, so this relieves my design of one of the objections urged.

The chief engineer reckons among the disadvantages of my system, that it is attended by "the exposure of steam to greatly increased cooling influences." Now, as such exposure amounts by actual computation to less than one-half of what it is in a Cornish engine of the same pumping capacity, I may regard still another objection of the chief engineer, as unfounded in fact.

It is charged that I have "much increased areas subject to friction." To this objection I have simply to say that it is not true, such areas being decidedly less than in a Cornish engine. The friction of the Hope pumping engine, in meeting the regular requirements of the high service, is demonstrated by the best known appliance to be only 35-100 of one horse power.

It is charged that there are a "great number of connections between the power and the work." A careful inspection of the machine at Hope station, will disclose the fact that between the steam piston where the power is generated, and the water-plunger, where the power is applied, there are just two connecting rods jointed at each end, making ten in all, and not nineteen as mis-stated. In the Cornish engine designed for the Providence Water Works, there are fourteen connecting rods, jointed at each end, connecting directly and indirectly with the main working-beam.

It is said that the connections are "unadjustable" "between the steam and water pistons." This is very true, but the object in view was of practical importance to meet the necessity at Hope pumping station, that the engine should run continuously night and day, from its first starting until its duplicate could be placed by its side to relieve it. Now, in designing an engine for Pettaconset, where no necessity exists for such continuous running, I should adopt the ordinary mode of constructing such connections, and in so doing, dispose of another objection of the chief engineer.

As to what is said of the relief-valve, put in by the water commissioners, I will content myself with simply referring you to a personal observation of its workings.

As to the comparison between "the pump-cards taken from the respective engines," I have only to say, that since the chief engineer admits the difference is owing solely to the use of an air-chamber at Pettaconset, the remedy is very simple, and can be applied at any time that its necessity is demonstrated, at a trifling cost compared with that of a stand-pipe, which latter it is optional with me to call for, to meet such a contingency.

Another disadvantage named, is "less favorable pumps." Why "less favorable," is not stated, but I think that it will be easily proved that the labor of taking out and re-placing pump-valves in my system, bears favorable comparison with like labor in a Cornish engine. The report of the Louisville Water Company, for 1872, gives, among other information, the cost of repairs on their two Cornish engines, each having cylinders 70 inches diameter by 10 feet stroke. One item of this cost is "labor taking out and replacing pump-valves, $131." After I had started my engine on pumping the water in a circuit, and while I was waiting for a relief-valve to be attached by the commissioners, I had *all* the valves of my pumping system taken out, examined and replaced at an expense of less than six dollars, and I find from actual data, that I can furnish an entire new set of valves and place them in the pumps for two hundred and seventy-five dollars, whereas the taking out, repairing and replacing of two Cornish valves was, by the report above referred to, five hundred and sixty dollars and twenty cents. The specifications for the Cornish pumping engine, for Providence Water Works, call for twenty-one of these valves.

Although the chief engineer says, "in stating the results of the run so far made by the Hope engine, I wish it clearly understood that I do not consider them to be a fair representation of what the engine may probably do hereafter:" he, however, after stating what is meant by the term duty, as applied to pumping engines, proceeds to present in contrast, the duty obtained by the Hope pumping engine, with that of the largest pumping engines in the world, without one word of explanation of the different conditions of their respective workings.

That the *present rate of consumption* of fuel at the Hope station is below the expectations of those who are responsible for the dimensions of the coal vaults which have been provided there, may be inferred from the fact that these vaults are of a capacity sufficient for three years' supply.

You are aware that the Worthington engine, now running at Pettaconset, was originally intended to be permanently located at the Hope pumping station. It is claimed, that it now gives a duty of 40,000,000 pounds, in performing the work required at Pettaconset. If it could continue to give that "duty" after being removed to the Hope station and operated under the advantages and disadvantages that exist there, and are consequent upon the peculiar requirements of that station, then it follows that these coal vaults, once filled, would suffice to supply that engine for the term of 14 years, 2 months and 26 days. The chief engineer, in an early report upon the Pettaconset engine, has given his opinion that it was admirably adapted to the service at the Hope station. If he still clings to this opinion, and it will continue to give a forty millions duty when transferred to this new sphere of labor, then it follows that the money which has been expended upon these coal vaults, if put at interest at 7 per cent would give an annual sum equal to the cost of the annual supply of coal for doing the present work at that station, forever.

The Hope pumping engine, in performing its present work, is restricted to an average movement of *nine-tenths of one revolution per minute.* Its five steam cylinders, (each of which, in the ordinary work of an engine for manufacturing purposes, would give one hundred horse power,) are here restricted to fifty-five one hundredths of one horse power each, making two and three-fourths horse power for the five cylinders combined. A boiler is used for furnishing steam which is usually employed for 141 horse power. The fires are required to be kept up night and day without interruption, from month to month. In view of these facts, there is nothing to relieve the whole outlay at the Hope station from utter absurdity and reprobation, but the consideration that the superfluous power is always to be held in reserve for the exigencies of a conflagration. To expect economical pumping in such circumstances, is simply absurd. And when the trial of the Hope pumping engine is made, according to the conditions of the contract, the Pettaconset engine will be subjected to the test of performing just such service as is required at the Hope station, as well as pumping 2,000,000 gallons in twenty-four hours, under the pressure of water required at Hope station. Then will come my vindication from the injustice of the reports which you have received from the water commissioners and their chief engineer, as to the performances of the Hope pumping engine.

With regard to those columns of figures, by which it is attempted to prove that the city of Providence would be justified in refusing the gift of an engine which would give only a duty of 40,000,000, I have to say, that this duty is about the present average duty of Cornish engines in this country; and any calculation based upon a better result, is based upon the prospective success of the schemes of *amateurs*, and they are simply the result of "the investigations of theory."

The chief engineer says, that "the experience of other cities has shown the great risks and disadvantages of trying new experiments in pumping water." It is my deliberate judgment, that the experience of cities in trying experiments with the Cornish engine, has involved more disappointments and loss of money, than any and all other plans that have ever been tried. These experiments have been induced by the extravagant reports that have appeared, as to the performances of the engines at the Cornish mines; which reports, have, for the last thirty years, given a false standard for judging of the practical merits of pumping engines throughout the world.

In support of this statement, I refer to the following authorities. Bourne, in the eighth edition of his work on the steam engine, page 254, says, "the performance of the Cornish engine has not improved since the first edition of this work appeared, but, on the contrary, has retrograded." A reference to the preface of the work, fixes the date of that first edition in April, 1846, and the eighth edition is dated, "London, February 10th, 1868."

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